

## Appendix A

## Water & Sewer Design

(Revised 5/04/06)

### All other sections remain the same

#### 1.2.1 FIRE DEMAND

Demand forecasting projects the future water use based on historic use factors, socioeconomic trends, climatic factors and other parameters. Distribution system design must also account for peak periods of daily use. Peak factors are a function of land use, present population, and population growth rate. Older established areas tend to have peak factors two to three times lower than those of rapidly expanding areas. Although the overall volume of water used for fighting fires is quite low relative to most other uses, the rate at which it must be supplied places a heavy, short-term drain on the system.

***The estimated fire flow can be established using the Insurance Services Office (ISO) "Guide for Determination of Needed Fire Flow," latest revision or, NFPA, or 2003 International Fire Code Appendix B. All TRC projects shall have fire flows calculated submitted to the City Fire Marshall and City Engineer for approval during the TRC process. The calculations shall include calculations verifying the required fire flow and pressures can be achieved. All calculations shall be sealed by a professional engineer. Calculations for subdivisions shall be submitted during the RWS plan review process.***

#### 1.2.2 DISTRIBUTION SYSTEM

- A. **General:** Distribution systems shall meet the minimum requirements of **The Code of Virginia, Commonwealth of Virginia, Department of Health**, latest revision.

The subdivider shall connect the subdivision with the municipal water system at his expense, and shall construct it in such a manner as to serve adequately for both domestic use and for fire protection on all lots shown on the Subdivision Plat for any development either within the corporate City Limits of Lynchburg, according to Chapter 24 (24.1-19, 20, 21, 21.1) Subdivisions of City of Lynchburg Code.

- B. **System Design:** As part of the design, the City Engineer may require the Engineer to model new portions of the system using the **University of Kentucky Kentucky Pipe** or **WaterCAD** software. The design data shall include a sketch of the system showing assumed minor losses, pipe roughness ("C" Constants assumed), line lengths, fixed grade node elevations, node numbers, demands, pipe numbers, time of day of field test of hydrant (static pressure converted to elevation head) for verification of starting elevation head, the static water elevation in tank at the time a static pressure reading was taken and, ground elevation of hydrant tested.

C. **Piping Applications**

**General:** Use pipe, fittings and methods of joining in accordance with the following:

1) **Pipe that May be Used Underground:**

- a. **Water Mains:** 6-inch to 48-inch Ductile Iron Pipe
- b. **Services:** 3/4-inch to 2-inch Type K Copper,
- c. **Services greater than 2-inch:** Ductile Iron Pipe

2) **Pipe that May be Used Above Ground:**

- a. **Water Mains:** 6-inch to 48-inch Ductile Iron Pipe

D. **Joint Applications**

- 1) For underground applications, use push on or mechanical joints for 3-inch pipe and larger.
  - 2) For above ground or vaults, use flanged end joints.
  - 3) Provide transition couplings and special fittings with a pressure rating equal to or exceeding the pressure rating of the pipe or fitting to which they will be either connected or fitted.
  - 4) Do not use flanges, unions, or keyed couplings for underground piping.
- E. **Location:** Water mains shall be located within dedicated street rights-of-way or City utility easements. Water mains should, if possible, be located no closer than 5 feet from the lip of the curb.
- F. **Pressure:** Water distribution mains shall be sized to provide a minimum pressure at all points within the distribution system of not less than 20 psi (gauge) during periods of peak demand (fire flow).

- G. **Pressure Reducing Valves (PRVs):** When the maximum static pressure in a new system exceeds **80 psi**, businesses and/or residences shall be equipped with a pressure-reducing valve. The valve shall be located on the outlet side of the meter. It is the property owner's responsibility to install and maintain the PRV.
- H. **Pipeline Velocity:** 3 to 6-fps normal working conditions are preferred. Sustained high discharge velocities can scour the pipe's interior and increase leakage. Minimum velocity must be maintained to prevent sediment accumulation and bacteriological growth.
- I. **Main Size:** Minimum main size is 8 inches in diameter with fire hydrant lead-ins being at least 6 inches in diameter. However, a fire hydrant, in accordance with **Standard Detail 26.09**, will be required at the end of the 6-inch line. If the line can be extended in the future, as determined by the City Engineer, a temporary blow-off may be installed at the end of the line in accordance with **Standard Detail 26.10**.
- J. **DIP Minimum Thickness Class:**

**Table 3.1**

6" to 12"	class 50
14" to 20"	class 50
24"	class 50

- K. **Allowable Leakage:** See also Table I of specification Section 02660 – *Water Distribution*, paragraph 3.4.1, "Pressure Tests and Leakage."
- L. **Bury:** Under conditions which otherwise prevent minimum bury from being achieved, such as at crossings above shallow buried structures or rock, the minimum cover shall be no less than one foot less than minimum bury requirements, as approved by the City Engineer. See specification Section 02660 – *Water Distribution* and specification Section 02220 – *Trenching, Backfilling, and Compaction of Utilities*.
- M. **Dead End Lines** must have either a fire hydrant or blow-off assembly for flushing. However, the City Engineer must first approve the use of a blow-off assembly. 2-inch blow-off assemblies (**Standard Detail 26.10**) are typically to be used in situations where an extension to the end of an 8-inch or larger line is expected to be made. A fire hydrant shall be placed in accordance the **Standard Details 26.08 and 26.09**.
- N. **Sag Verticals:** Provide a fire hydrant as a sag blow-off when lines have a severe sag (such as when running beneath large streams, ditches or culverts where sediment can accumulate and retard flow in water line). Eliminate localized sags as much as possible.
- O. **Crest – Air/Vacuum Release Valves (ARVs):** Provide an ARV at all high points. The water line shall be designed and constructed to minimize localized high points.

- P. **Allowances for Main Expansion of Aerial Crossings:** Install expansion devices as necessary to allow expansion and contraction movements such as on aerial crossings. Provide insulation on exposed pipe.
- Q. **Fire Hydrants:** Fire hydrants shall not be installed on water mains of less than 8 inches in diameter. See **Standard Detail 26.09**.
- 1) **Fire Hydrant Location Guidelines:** Mid block hydrants will not be allowed unless approved by the City Engineer. Street hydrants shall be located either at the end of cul-de-sacs or at intersections.
  - 2) All hydrants are to be located in the street right-of-way or in a City of Lynchburg Utility Easement.
  - 3) **Minimum Fire Flow at Hydrants:** All hydrants: 500 gpm at 20-psi residual pressure.
  - 4) **Maximum Distances from Structures:** Per 2003 International Fire Code Section 508 and Appendix C. All distances shall be measured by the lay of the hose and not as the crow flies.
  - 5) **Maximum Distances between Hydrants:** Per 2003 International Fire Code, Appendix C, Table C105.1 for all development within the City. The maximum distance between hydrants in new subdivisions shall be 500 feet. All distances shall be measured by the lay of the hose and not as the crow flies.
  - 6) **Hydrant in Relation to Street:** See **Standard Detail 26.09**.
  - 7) **Hydrant Location in Relation to Siamese Connection:** A hydrant shall be placed on the "supply" side of the Siamese connection no more than 50 feet from the Siamese connection to allow the fire suppression personnel to charge the closed system. The hydrant must be completely accessible for truck pumper connection.
- R. **Valving:** Valves shall be installed at all branches from feeder mains and between mains and hydrants according to the following schedule:
- 1) Three valves at tees (except hydrant branches made on mains),
  - 2) Four valves at crosses,
  - 3) When downsizing a main, locate a valve after the reducer on the side with the smaller diameter. However, the designer must evaluate thrust forces and accommodate the forces by placement of a thrust collar (if required) on the larger main.

- 4) Valves on main distribution line runs shall not exceed the distance given below in Table 3.2. Where possible, main line valves shall not be located more than 50 feet from the nearest fire hydrant with a maximum spacing between valves as given below in Table 3.2.

**Table 3.2**

Main Size	Maximum Spacing
8-inch	1000 feet
12-inch	1000 feet

- 5) Valves on transmission main runs shall not exceed the distance given below in Table 3.3.

**Table 3.3**

Main Size	Maximum Spacing
16-inch or greater	2000 feet

#### **S. Relation of Water Mains to Sewers**

See specification Section 02660 – *Water Distribution*, Part 1 – General, paragraph 1.8 “Project Conditions” for separation requirements between water mains and sewer mains/manholes and water mains and drainage structures/streams.

- T. **Meter Location – Double Frontage Lots:** If a lot fronts on 2 or more streets, the meter shall front the same street as the lot’s address. Refer to the City of Lynchburg Service Installation Procedure.

#### **U. Cross-Connection Prevention**

Refer to the City Cross-Connection and Backflow Prevention Program. Contact the City Technical Service Coordinator at (434) 455-4260 for a copy.

- V. **Connecting Varying Pressure Zones:** Where 2 different pressure zones are connected, a Pressure Reducing Station may be required or a gate valve shall be set and a division marker placed in the valve box per **Standard Detail 26.17**.

#### **W. Testing**

See specification Section 02660 – *Water Distribution* for testing requirements.

#### **X. Thrust Block Anchors**

Concrete thrust block anchors, tie rods, restrained joint pipe, and/or other means of restraint shall be provided at all changes in pipe direction. Concrete thrust block anchors are not recommended where the blocking may bear on other utilities or where the area behind the block may be excavated in the future. See **Standard Detail 26.04**.

**Y. Water Meter Sizing**

All water meters shall be sized in accordance with the latest revision of AWWA M22. Meter size shall be approved by the Utilities Meter Supervisor at (434) 455-4259.

**Z. Manholes for Valves**

Manhole Cones: Eccentric cones are preferred in all cases.

**AA. Public Easements**

The width of easements (except when adjacent and parallel to right-of-way) shall be 15 feet. Consideration shall be given for deeper cuts (generally greater than 12 feet) by including an additional temporary construction easement (usually 10 feet). The City Engineer may require that the width of the permanent easement increase with the depth of water line for maintenance purposes.

Easements shall be fully accessible by rubber-tired vehicles in their entirety. The City may require stream fords. Stream fords shall be provided as specified in paragraph 1.3.5 E, *Fording Streams*, below.